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(54) A system and method for route guidance

(57) A route guidance system for vehicles comprises central computing apparatus (6), transmitting apparatus (1) by way of which the central computing apparatus (6) is informed of the positions of respective vehicles on a road network and by way of which the vehicles are supplied with route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to respective desired destinations, the transmitting apparatus (1) including transmitting devices (4) for carrying by the respective vehicles and by way of which the central computing apparatus (6) is informed as to the desired destinations, computing apparatus (8) serving to inform the central computing apparatus (6) as to traffic congestion on the network, and speech synthesisers (4) for carrying by the respective vehicles and arranged to speak instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations.

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Description

[0001] This invention relates to a route guidance system for vehicles.

[0002] According to one aspect of the present invention, there is provided a route guidance system for vehicles, comprising central computing apparatus, transmitting apparatus by way of which the central computing apparatus is informed of the positions of respective vehicles on a road network and by way of which the vehicles are supplied with route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to respective desired destinations, said transmitting apparatus including transmitting devices for carrying by the respective vehicles and by way of which the central computing apparatus is informed as to their respective desired destinations, informing apparatus serving to inform the central computing apparatus as to traffic congestion on said network, and presenting devices for carrying by the respective vehicles and arranged to present respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations.

[0003] According to a second aspect of the present invention, there is provided a route guidance method for vehicles, comprising informing central computing apparatus of the positions of respective vehicles on a road network, informing said central computing apparatus as to traffic congestion on said network, informing said central computing apparatus as to the respective desired destinations of vehicles, supplying to the vehicles route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to their respective desired destinations, and presenting respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations.

[0004] Owing to these aspects of the invention, drivers can be informed as to the best routes for their vehicles to take to their respective destinations, in such manner that traffic congestion pertinent to the routes is taken into account.

[0005] Advantageously, the transmitting apparatus transmits to a vehicle a short burst of route guidance data relating to the best route to the desired destination of the vehicle and then ceases transmitting route guidance data to that vehicle, preferably ceases transmitting to that vehicle any data whatsoever, unless and until a need for further transmission arises, for example the traffic congestion pertinent to the given route changes significantly.

[0006] Thus, according to a third aspect of the present invention, there is provided a route guidance system for vehicles, comprising central computing apparatus, transmitting apparatus by way of which the central computing apparatus is informed of the positions of respective vehicles on a road network and by way of which the vehicles are supplied with route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to respective desired destinations, said transmitting apparatus including transmitting devices for carrying by the respective vehicles and by way of which the central computing apparatus is informed as to their respective desired destinations, and presenting devices for carrying by the respective vehicles and arranged to present respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations, and wherein, in respect of each vehicle, said transmitting apparatus provides a channel of communication which is opened to transmit said route guidance data to the vehicle in a short burst and is then closed, so that transmission to the vehicle via said channel ceases, unless and until a need for further transmission via said channel to said vehicle arises.

[0007] Similarly, according to a fourth aspect of the present invention, there is provided a route guidance method for vehicles, comprising informing central computing apparatus of the positions of respective vehicles on a road network, informing said central computing apparatus as to the respective desired destinations of vehicles, supplying to the vehicles route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to their respective desired destinations, and presenting respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations, said supplying of said route guidance data to the vehicles comprising, for each vehicle, opening a channel of communication to transmit the route guidance data to the vehicle in a short burst and then closing said channel of communication so that transmission to that vehicle via said channel ceases, unless and until a need for further transmission via said channel to said vehicle arises.

[0008] A particular advantage of these two aspects of the invention is that the transmission channel need not be kept permanently open.

[0009] Moreover, it is advantageous if, when a driver of a vehicle wishes to inform the central computing apparatus of his desired destination, that apparatus is informed by way of a human operator to whom the desired destination is communicated by presenting means, preferably verbal and aural, and who not only feeds the relevant information into the central computing apparatus, but also communicates orally with the driver. In this way, the driver does not need to communicate with the central computing apparatus by way of a key pad, for example, and he has the comfort of dealing with a fellow human being.

[0010] If desired, upon the central computing apparatus being given the desired destination of a vehicle, the driver is informed as to the likely journey time.

[0011] In order that the invention may be clearly and completely disclosed, reference will now be made, by

way of example, to the accompanying drawing which shows a diagram of a route guidance system for road vehicles.

[0012] Referring to the drawing, the system includes an off-board call centre 2 with which respective in-vehicle devices (of which one is shown and reference 4) can communicate via respective connections 3 of respective channels 1 of communication provided by a mobile telephone network. The in-vehicle devices are installed in respective vehicles of subscribers to the system and each device contains a GPS (Global Positioning System) receiver, a mobile telephone device, a speech synthesiser, a control microprocessor and a memory for speech synthesis. The memory of the device 4 stores a vocabulary of words and phrases. Each word or phrase is activated by a token in a compressed data message supplied by the computer 6 via a connection 5 and giving a calculated best route to a desired destination. The compressed data message is received by the in-vehicle device 4 at the commencement of the journey and comprises a stream of what are called "route points", which are GPS positions along the best route, the message including, for some of the route points, respective strings of tokens. For any best route, route points are provided frequently and in particular at every position at which an instruction to the driver is required to be made (for every manoeuvre that the driver is required to make, there may be up to three route points where instructions are given and in advance of the actual position where the manoeuvre must be made), and both before and after each possible diversion from the best route, and, in any case, at intervals not greater than, say, 1 mile. A string of tokens generates speech in at least one spoken sentence by assembling the words and phrases in the order that the relevant tokens are triggered by the arrival of the vehicle at a given latitude and longitude.

[0013] A human operator in the call centre 2 and an off-board central computer 6 for route guidance can communicate with each other, whilst the operator and an off-board central computer 8 for traffic congestion can also communicate with each other. The computer 8 receives information as to traffic congestion from a number of sources, such as roadside speed sensors and traffic reports for a road network. The computers 6 and 8 can also intercommunicate so that the computer 8 can supply to the computer 6 RTTI (real time traffic information) and HTI (historical traffic information). HTI is formatted traffic information that has been compiled over preceding weeks and months as an output of the computer 8.

[0014] The computer 6 intercommunicates with a website 10 so that the user can access the computer 6 via the website 10 to supply route preferences in particular; with an off-board traffic repository 12 which stores historical traffic information and road closures data that overrides the default link impedances (speeds) from an off-board map database 16; and with an off-board API (application programming interface) 14 which provides an interface to the map database 16. The API intercommunicates with the map database 16 via requests and responses. The map database 16 has, in effect standard default link impedances which are dependent upon the expected speeds of traffic along respective links of the road network. The computer 8 intercommunicates with an off- board historical traffic information database 18 so that the computer 8 can access the database 18 to supply HTI to the database 18 which stores HTI and which supplies HTI to an off-board map compiler 20 which is used to format map data from an independent vendor together with RTTI, HTI and the standard impedance (speed) for each road link. The map compiler 20 in turn communicates with the map database 16. The computer 8 also intercommunicates with an off-board database 22 so that the computer 8 can access the database 22 to supply user data to the database 22 and to update RTTI and HTI relevant to the routes. The database 22 stores data as to the user's profile (such as the user's name and address and his type of vehicle), the user's preferred routes (such as the shortest route, the fastest route, or a route using motorways or avoiding motorways), and predefined routes for which the user would wish to be alerted to changing traffic conditions. The database 22 also intercommunicates with the operator in the call centre 2 so that the operator can access the information in the database and can amend it at the request of the user; with the website 10 so that the user can access via the website the information in the database 22 and can amend it via the website; and with a customer service department 24 so that the department can access the information in the database and can amend it as required. The computer 8 can also communicate directly with each in-vehicle device via a connection 26. For ease of explanation the connections 3, 5 and 26 for one device 4 are shown as separate connections but, in practice, they will all be a single channel 1 of communication, for example a single mobile telephone connection.

[0015] The method of operation of the system is as follows. A driver in a vehicle uses the device 4 to telephone the call centre operator, giving his intended destination, while the device 4 supplies automatically over the connection 5 to the computer 6 initially its CLI (calling line identity) and then the GPS position of its vehicle. The operator supplies the desired destination to the computer 6, which calculates the best route, taking into account the user's route preferences and also the traffic conditions, particularly traffic congestion, as supplied by the computer 8 and the repository 12. The computer 6, via the connection 5, downloads in a single transmission to the device 4 a compressed data message including all route points in respect of the entire best route to the desired destination, these route points including "trigger" points along the route where strings of tokens attached to the trigger points will cause the driver to be given spoken instructions by the speech synthesiser. The route points included in the compressed data mes-

sage are representations of respective positions, i.e. latitudes and longitudes, such that, when the vehicle attains a particular position, i.e. latitude and longitude, as determined by the GPS receiver, the appropriate instructions are given by the speech synthesiser. The communication channel 1 is then closed, so that the computer 6 ceases to communicate with the device 4 for the rest of the journey, unless the driver requests a different route or destination, or unless traffic conditions have changed, in which case the user is alerted of that change by the channel 1 being re-opened. At each trigger point, identified by its GPS position, the control microprocessor in the device 4 identifies the relevant position, whereupon the relevant token (s) cause(s) the speech synthesiser to instruct the driver as to what action to take (for example, at a roundabout, "turn left", "turn right", or "straight over"). If the driver is alerted to a change of traffic conditions by the computer 8 re-opening the channel 1, he can, by simply pressing a button of the device 4, request to have a new best route calculated and downloaded from the computer 6 in a new compressed data message.

[0016] If the driver switches off the vehicle ignition, the route is retained for, say, one hour and navigation is resumed when the vehicle moves off again. Beyond one hour, the device 4 automatically re-sets and the driver will need to re-start the route guidance method from scratch.

[0017] The device 4 internally checks that the vehicle has not left the best route. In the compressed data stream which has been downloaded to the device 4, the distance between each pair of route points is defined. The device 4 continuously checks the distance actually travelled from the first route point of a pair and, if the vehicle is detected as having travelled a greater distance than the reference distance between the two route points without having reached the second point of the pair, the device 4 warns the driver by a spoken message from the speech synthesiser that he has left the best route. The driver may then request a re-route to the desired destination by pressing the button on the device 4 to open the channel 1 and obtain a new best route from the computer 6. Alternatively, if the user has configured on the website 10 that automatic re-routing is required, then the device 4 will automatically request a new best route by opening the channel 1 and communicating with the computer 6 when it detects that the vehicle has left the best route.

[0018] The system described with reference to the drawing has the advantages of being relatively easy to use and of being relatively inexpensive both as regards the cost of equipment (because a minimal amount of equipment is provided in-vehicle) and the running costs (particularly because the channel of communication between the computer 6 and the in-vehicle device 4 is open only when necessary and for a very short time period).

Claims

1. A route guidance system for vehicles, comprising central computing apparatus, transmitting apparatus by way of which the central computing apparatus is informed of the positions of respective vehicles on a road network and by way of which the vehicles are supplied with route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to respective desired destinations, said transmitting apparatus including transmitting devices for carrying by the respective vehicles and by way of which the central computing apparatus is informed as to their respective desired destinations, informing apparatus serving to inform the central computing apparatus as to traffic congestion on said network, and presenting devices for carrying by the respective vehicles and arranged to present respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations.

2. A system according to claim 1, wherein, in respect of each vehicle, said transmitting apparatus serves to transmit route guidance data for the entire best route to the vehicle in a short burst and then ceases transmitting any route guidance data to that vehicle, unless and until a need for further transmission arises.

3. A system according to claim 2, wherein, in respect of each vehicle, said transmitting apparatus not only serves to transmit said route guidance data in said short burst but also then ceases transmitting to the vehicle any data whatsoever, unless and until said need arises.

4. A system according to any preceding claim, and further comprising storing apparatus for storing historical traffic information, and a map database in which representative data representing expected speeds of traffic along respective links of the road network are stored and form the basis for calculation by the central computing apparatus of said best routes unless said central computing apparatus overrides said representative data with historical traffic information from said storing apparatus or with real time traffic information from said informing apparatus.

5. A system according to claim 4, wherein said map database stores said representative data in the form of default road link impedances, and said central computing apparatus overrides said representative data by changing said impedances and then calculates new best routes for the vehicles taking into account the changed impedances.

6. A system according to any preceding claim, where-

in said informing apparatus serves to inform the central computing apparatus of changes in traffic congestion on said network and said central computing apparatus serves, by way of said transmitting apparatus, to alert the drivers to traffic congestion changes relative to existing best routes for the respective vehicles.

7. A system according to claim 6, wherein, for each vehicle, said transmitting apparatus is usable by the alerted driver to cause the central computing apparatus to be requested to supply to the vehicle, by way of said transmitting apparatus, route guidance data for a new best route taking into account the traffic congestion changes.

8. A system according to any one of claims 1 to 5, wherein said informing apparatus serves to inform the central computing apparatus of changes in traffic congestion on said network and said central computing apparatus serves, for each vehicle, automatically to supply to the vehicle, by way of said transmitting apparatus, a new best route taking into account the traffic congestion changes.

9. A system according to any preceding claim, wherein, for each vehicle, said central computing apparatus serves to supply said route guidance data in the form of a compressed data message comprised of a stream of route points along the best route.

10. A system according to claim 9, wherein said presenting devices comprise respective speech synthesisers and, for each vehicle, the message includes, for some of the route points, respective strings of tokens representing words or phrases of respective spoken instructions to the driver.

11. A system according to claim 9 or 10, and further comprising, for carrying by the respective vehicles, microprocessors and GPS receivers connected to the respective microprocessors, each microprocessor serving to compare a reference distance in the form of the distance between first and second adjacent route points as supplied by said central computing apparatus with the actual distance travelled by its vehicle as supplied by its GPS receiver in order to indicate any significant diversion from the existing best route.

12. A system according to claim 11, wherein, for each vehicle, its microprocessor serves to cause the driver to be warned in the event that said actual distance significantly exceeds said reference distance and said transmitting apparatus is usable by the warned driver to cause the central computing apparatus to be requested to supply to the vehicle, by way of said transmitting apparatus, route guidance data for a new best route taking into account the diversion from the existing best route.

13. A system according to claim 11, wherein, for each vehicle, in the event that said actual distance significantly exceeds said reference distance, its microprocessor serves, by way of said transmitting apparatus, to cause the central computing apparatus automatically to supply to the vehicle, by way of said transmitting apparatus, a new best route taking into account the diversion from the existing best route.

14. A system according to any preceding claim, and further comprising a call centre for manning by human operators and arranged to be interposed between the drivers and the central computing apparatus for relaying to the central computing apparatus information given orally by the drivers as to their respective desired destinations.

15. A route guidance method for vehicles, comprising informing central computing apparatus of the positions of respective vehicles on a road network, informing said central computing apparatus as to traffic congestion on said network, informing said central computing apparatus as to the respective desired destinations of vehicles, supplying to the vehicles route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to their respective desired destinations, and presenting respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations.

16. A method according to claim 15, wherein said supplying of said route guidance data to the vehicles comprises, for each vehicle, transmitting route guidance data for the entire best route to the vehicle in a short burst and then ceasing to transmit any route guidance data to that vehicle, unless and until a need for further transmission arises.

17. A method according to claim 16, wherein, in respect of each vehicle, following said supplying of said route guidance data to the vehicle, ceasing transmitting to the vehicle any data whatsoever, unless and until said need arises.

18. A method according to any one of claims 15 to 17, and further comprising storing historical traffic information, storing representative data representing expected speeds of traffic along respective links of the road network, and using said representative data for calculation of said best routes in said central computing apparatus unless said central computing apparatus overrides said representative data with

said historical traffic information or with real time traffic information as to said traffic congestion.

19. A method according to claim 18, wherein said storing of said representative data is in the form of default road link impedances and said representative data is overridden by changing said impedances.

20. A method according to any one of claims 15 to 19, wherein said informing of said central computing apparatus as to traffic congestion on said network includes informing said central computing apparatus of changes in traffic congestion on said network, said method further comprising alerting the drivers to traffic congestion changes relative to existing best routes for their respective vehicles.

21. A method according to claim 20, wherein one of the alerted drivers causes the central computing apparatus to supply to his vehicle route guidance data for a new best route taking into account the traffic congestion changes.

22. A method according to any one of claims 15 to 19, wherein said informing of said central computing apparatus as to traffic congestion on said network includes informing said central computing apparatus of changes in traffic congestion on said network, said method further comprising automatically supplying to said vehicles new best routes taking into account the traffic congestion changes.

23. A method according to any one of claims 15 to 22, wherein, for each vehicle, said route guidance data is supplied in the form of a compressed data message comprised of a stream of route points along the best route.

24. A method according to claim 23, wherein, for each vehicle, said message includes, for some of said route points, respective strings of tokens representing words or phrases of respective spoken instructions to the driver.

25. A method according to claim 23 or 24, and further comprising, for each vehicle, comparing a reference distance in the form of the distance between first and second adjacent ones of said route points with the actual distance travelled by the vehicle, to indicate any significant diversion from the existing best route.

26. A method according to claim 25, wherein, for each vehicle, the driver is warned in the event that said actual distance significantly exceeds said reference distance and the warned driver causes the central computing apparatus to supply to his vehicle route guidance data for a new best route taking into account the diversion from the existing best route.

27. A method according to claim 25, wherein, for each vehicle, in the event that said actual distance significantly exceeds said reference distance, said central computing apparatus is caused automatically to supply to the vehicle a new best route taking into account the diversion from the existing best route.

28. A method according to any one of claims 15 to 27, wherein information given orally to human operators by the drivers as to their respective desired destinations is relayed by the human operators to the central computing apparatus.

29. A route guidance system for vehicles, comprising central computing apparatus, transmitting apparatus by way of which the central computing apparatus is informed of the positions of respective vehicles on a road network and by way of which the vehicles are supplied with route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to respective desired destinations, said transmitting apparatus including transmitting devices for carrying by the respective vehicles and by way of which the central computing apparatus is informed as to their respective desired destinations, and presenting devices for carrying by the respective vehicles and arranged to present respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations, and wherein, in respect of each vehicle, said transmitting apparatus provides a channel of communication which is opened to transmit said route guidance data to the vehicle in a short burst and is then closed, so that transmission to the vehicle via said channel ceases, unless and until a need for further transmission via said channel to said vehicle arises.

30. A route guidance method for vehicles, comprising informing central computing apparatus of the positions of respective vehicles on a road network, informing said central computing apparatus as to the respective desired destinations of vehicles, supplying to the vehicles route guidance data calculated by the central computing apparatus as to the best routes for the respective vehicles to take to their respective desired destinations, and presenting respective instructions to the drivers of respective vehicles as to the routes to be taken to their respective desired destinations, said supplying of said route guidance data to the vehicles comprising, for each vehicle, opening a channel of communication to transmit the route guidance data to the vehicle in a short burst and then closing said channel of communication so that transmission to that vehicle via

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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 3190

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 August 2002	Coffa, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 3190

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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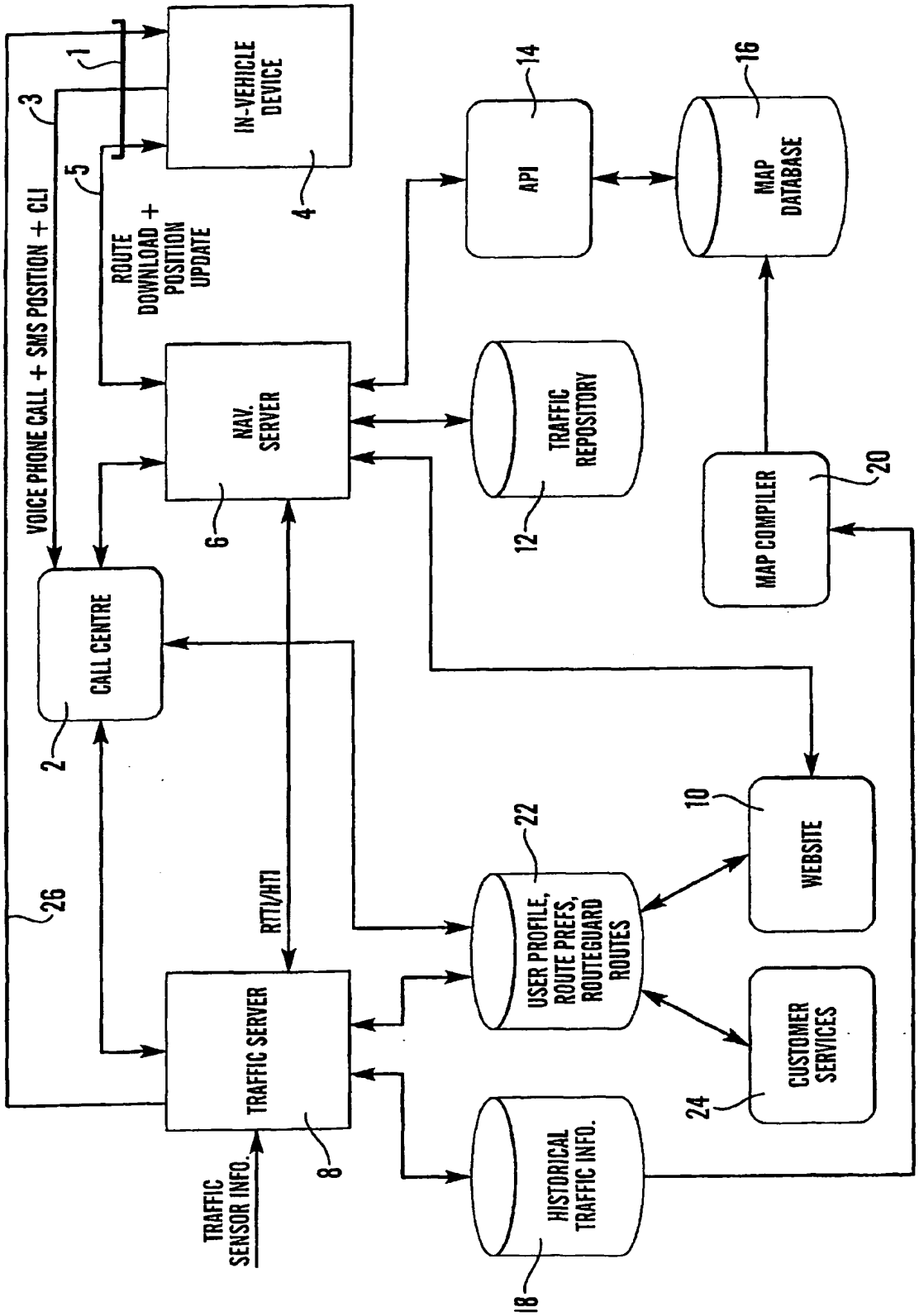
said channel ceases, unless and until a need for further transmission via said channel to said vehicle arises.


IN-VEHICLE DEVICE
4
1
3
5
VOICE PHONE CALL + SMS POSITION + CLI
ROUTE DOWNLOAD + POSITION UPDATE
API
14
MAP DATABASE
16
NAV. SERVER
6
TRAFFIC REPOSITORY
12
MAP COMPILER
20
CALL CENTRE
2
26
RTTI/HTI
USER PROFILE, ROUTE PREFS, ROUTEGUARD ROUTES
22
WEBSITE
10
TRAFFIC SERVER
8
CUSTOMER SERVICES
24
TRAFFIC SENSOR INFO.
HISTORICAL TRAFFIC INFO.
18

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 25 3190

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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